PORTABLE GAS POWERED FLUID DISPENSER

FIELD OF THE INVENTION

The following invention relates to portable, powered fluid dispensers, including caulking guns and other devices for dispensing viscous materials, including sealants, lubricants, pastes, epoxies, and other viscous materials. The present invention includes caulking guns, grease guns and other dispensers for viscous materials. The dispensing devices of the present invention will have application in various residential, commercial, construction and industrial applications in which viscous materials will be dispensed.

BACKGROUND

Dispensable, viscous materials such as adhesives, epoxies, sealants, including caulking, pastes, lubricants, and other viscous materials are typically packaged in rigid, thermoplastic tubular containers, or spiral bound cardboard tubes. To some extent, although not as often, some of these viscous materials come pre-packaged in tubular, sausage type containers having a relatively strong, but flexible outer impermeable skin to encapsulate the viscous material.

The rigid containers are often provided with pre-attached nozzle tips made from a thermoplastic material that is sealed against entry of air and to prevent the viscous material from escaping from the container. An air seal may be provided between the main portion of the tube containing the viscous material, and the base of the hollow nozzle tip. A user will typically cut away a portion of the nozzle tip, to create an opening to dispense the viscous material, and then will pierce the air seal (through the newly created opening), so that when in use, the viscous material will enter the channel of the hollow nozzle and exit from the cut opening at the nozzle tip. The user will then try to carefully apply sufficient pressure to the contents of a caulking gun or other dispensing device to apply a uniform bead of material to a target surface. The inability to apply an uniform bead is a common problem associated with

hand operated caulking guns, and powered dispensers fitted with conventional nozzles, including aerosol containers filled with dispensable materials such as caulking or other sealants.

Unfortunately, it is relatively difficult for inexperienced users and many trained workers to apply uniform beads of material over extended periods of time. Conventional hand operated devices are prone to significant variations in bead quality and appearance. Even if an operator is provided with a conventional, powered dispensing device, it is difficult for the operator to control the flow rate at which the viscous material is dispensed and deposited to a target area.

One of the most common types of existing tubular container designs includes the fixed, hollow nozzle tip made from polyethylene or other thermoplastic material, briefly described above. The nozzle tip is fixed to the container, and if the affixed, conventional nozzle tip is spoiled, plugged, or rendered unusable, the entire container must be thrown away because the user will not have a convenient, cost effective replacement for the spoiled nozzle tip. Furthermore, the prefixed nozzles are not provided with replaceable or interchangeable nozzle tips. Essentially, a user is not provided with a selection of interchangeable tips that could be used to dispense different shapes and sizes of beads.

There are many other disadvantages to using known conventional nozzle designs and conventional dispensing devices. By way of further example, but not by way of limitation, prefixed nozzles cannot be removed for cleaning and cannot be reused. Once the container is emptied, the container and the nozzle tip are discarded. There are also other disadvantages associated with prefixed nozzles in that the overall container size is greatly increased by the added length of the prefixed nozzle component. The added length makes it necessary for manufacturers and others to package the containers in relatively large boxes to accommodate the added space occupied by the nozzles. If the nozzle of a container is damaged during shipping or

handling, the entire damaged container and its contents are typically discarded, resulting in significant losses and higher costs. Earlier nozzle designs of this type are not readily adaptable for use in dispensing viscous materials from sausage type containers. Furthermore, these conventional nozzle designs do not provide features to control the flow rate for dispensing the viscous materials from lightweight hand held dispensing devices, including caulking guns.

SUMMARY OF THE INVENTION

The present invention is adaptable for use with a wide variety of fluid containers, including caulking tubes and sausage-type containers, grease tubes, tubes containing sealants, adhesives, and mastics, prepackaged food stuffs in tube type containers, and the like. The invention may also be applied to handheld devices that may be powered by stationary compressors or battery powered portable air compressors, electrically powered hand tools and other dispensing devices. Although certain examples and embodiments of the invention will be explained in connection with caulking guns and hand held portable devices, including caulking guns, the invention may be embodied in many other devices and other equipment for dispensing viscous materials. For example, caulking guns may be used to dispense a wide variety of viscous materials for use in manufacturing, construction, repair and other applications and activities. In some instances, the hand held device may be powered by pressurized fluids other than pressurized gases such as air or CO_2. For example, it may be desirable to use embodiments of the invention in association with pressurized water lines or hoses supplying other pressurized liquids. Certain embodiments of the invention may be adapted for operative fluid connection with the lines or external reservoirs capable of providing pressurized fluid. In many instances, urban water systems include water lines capable of supplying flowing water pressurized in a range of about 30 psi to 60 psi pressure. The invention may be modified to accommodate a pressurized water source to adequately power the

dispensing device to dispense a range of commonly used viscous materials at above-freezing temperatures. However, preferred embodiments of the invention include hand held dispensing devices powered by pressurized gases including air or CO_2. Preferably, the pressurized gases are charged in a storage reservoir provided within the device.

In one aspect, the invention is a hand held dispensing device defining a sealable chamber capable of preventing escape of pressurized operating fluids, including air or CO_2, water, or other fluids used to power the device. (For ease of reference, the terms "sealable chamber" and "sealable housing" include chambers and housings designed to inhibit unintended escape of various pressurized gases and other fluids.) The chamber is made to receive containers that are typically manufactured and supplied separately, apart from the dispensing device. The device receives these later acquired containers within the chamber. In some instances, the chamber may be varied (for example, by replacing an existing modular housing with another housing of different size and shape) to receive a different type or size of container. In some instances, the container may be a rigid tube defining a hollow sleeve. Typically, the rigid tube comes with a plunger loaded within the hollow sleeve, to expel the viscous material from the tube, when the plunger is subjected to load. In this case, the rigid tube and the plunger are loaded into the chamber together, and after use, the tube and the included plunger are removed from the chamber. It is preferred that pressurized fluids introduced into the chamber during operation (for example, compressed gas) will surround the sleeve and an exposed surface of the plunger so that there will be an equalization of pressure around the tube, to maintain a tight seal between the sleeve and the plunger positioned within the sleeve. In many instances, this feature will discourage the sleeve of the tube from ballooning outwardly to fill any gaps that may exist between the sleeve of the tube and the interior walls of the chamber. The equalizing pressurized gas surrounding the sleeve

inhibits ballooning of the sleeve and possible movement of the inner wall of the sleeve away from the internal plunger. (By way of comparison, in earlier caulking gun designs, there is a tendency for such ballooning to occur, thus allowing pressurized gas to blow by the plunger of a caulking tube, bubble through the viscous fluid, and spoil the quality of the caulking bead being dispensed from the tube.)

In other instances, the chamber will be loaded with a container for viscous material that is a collapsible tube made with relatively thin, outer walls which may be folded as or when the container is emptied. Because the walls of these sausage type containers are still relatively flexible even when the container is filled, the containers will tend to fill the interior space of the chamber in the housing. Consequently, in many instances, the present device may be provided with a standard housing suitable for receiving the most common sizes of rigid tubes and sausage type containers. Where a collapsible tube is used, it is preferable to load a plunger piece into the chamber so that the plunger will press against one end of the sausage, to urge the viscous fluid to flow to a nozzle assembly. It is preferred that the plunger will form an air tight seal between itself and the interior wall of the surrounding chamber. An air tight seal should be provided to inhibit compressed gases or other pressurized fluids from by-passing the plunger, and interfering with the efficient expulsion of viscous material from the collapsible container. It is preferred that the compressed gases or other pressurized fluids will preferentially act upon an exposed surface of the plunger (and a corresponding end wall of the collapsible container), without imparting any significant pressure on other surfaces of the compressible container. If the plunger is not tightly sealed for sliding movement within the chamber, there may be a tendency for compressed fluids (for example, compressed gas) to by pass the plunger and flexible container and blow out of the nozzle, or create bubbles in the viscous material expelled from the dispensing device. It is also preferred that the plunger define a recess for gathering a folded portion of a

collapsible container, as viscous material is expelled from that portion of the container. Preferably, the plunger piece may be removed from the chamber after use. A funnel may also be provided to fit over the other end of the collapsible container, to channel viscous material being expelled from the container, toward the nozzle assembly. A funnel may be used to minimize unwanted deposits of viscous material within the housing. After use of the collapsible container, the spent container and the funnel may be simultaneously withdrawn to prevent excess material from dirtying the interior of the housing. In other instances, it may be desirable to leave the funnel in place within the housing, if the operator expects to load the chamber with another container, or if the funnel is clean enough for later use.

As noted, the device also includes a nozzle assembly for fluid communication with the container for a dispensable viscous fluid. The nozzle assembly includes a base that can be secured, fastened or operatively associated for fluid communication with a container for a dispensable viscous material. Preferably, the nozzle assembly is securable to the container or to the dispensing device, to inhibit seepage or escape of the viscous material. In certain embodiments, the nozzle assembly will not be secured or fixed to either piece, when installed within the device, but the nozzle assembly will be positioned in a manner that will direct an enclosed flow of the viscous material from the container to the dispensing tip of the nozzle assembly. In some aspects, the body of the nozzle assembly defines a housing for a valve gate. The gate operates between a first (fully open) position, and a second (fully closed) position. The gate may also be positioned in a range of positions between the first and second positions, to provide a variable flow rate of viscous material through the nozzle assembly. The valve gate may be a rotating spindle, a sliding gate, or other structure capable of providing a range of valve openings between fully open and fully closed positions. The device may also include a variable flow control element, such

as for example, a finger activated trigger. Other embodiments may include different control elements. For example, separate controls may be provided to control the flow rate of viscous material exiting from the nozzle assembly and pressurized fluids moving through the conduit.

In certain embodiments, a hand operated first control may be used to operate a valve (for example, the valve gate) throughout a range of positions, to impart a variable flow rate through the nozzle assembly. That hand operated first control may include a linkage between a hand operated element (for example, a finger operated trigger) and an actuator for the valve gate. In some of the embodiments illustrated further below, several flexible guides (including flexible strap portions) are described. However, many other linkages are possible for use as suitable hand operated control features.

In another aspect, the nozzle assembly is detachable from the container or dispensing device. In a preferred embodiment, the base of the nozzle assembly is attached to a container for viscous fluid (or to the dispensing device). Although the nozzle base may also be detachable from the container (or dispensing device), the assembly includes a detachable nozzle tip which is attached to the nozzle base for operation, and is detached from the nozzle base, for replacement with another interchangeable tip, or for storage. An optional reclosure cap may also be provided. The reclosure cap may be provided with two portions. A first portion of the reclosure cap may be used to cover the opening of the nozzle tip piece, and a second portion of the reclosure cap may be used to cover an opening on the base of the nozzle assembly.

In another aspect, the detachable nozzle tip may be interchangeable with one or more nozzle tips capable of dispensing beads of different shapes and sizes.

In yet another aspect of the invention, the device may include a nozzle assembly provided with a feature to mount the nozzle assembly for use in connection with a

conventional container such as a caulking tube, sausage or other conventional container including a conventional, prefixed nozzle piece. The existing prefixed nozzle piece on a conventional container may be trimmed or cut away, to leave a mounting stem. The nozzle assembly may be secured to the remaining stem on the viscous fluid container, or the nozzle assembly may be operatively associated in some other way with the container to allow fluid communication between the container contents and the nozzle assembly.

In certain embodiments of the invention, a tapered interior fluid channel is defined by the interior of the nozzle assembly, including an alignable opening in the valve gate, so that a continuous, tapered channel is provided along the longitudinal axis of the assembly, extending from the base of the assembly to the dispensing end. A simple, reusable or disposable cleaning tool with a matching taper may be used to clean the channel after use.

Although many embodiments of the invention may be manufactured for use with disposable nozzles made from inexpensive and lightweight materials, for disposal after a single use, other embodiments may be provided with reusable nozzle assemblies, and related components, for prolonged or repeated use, where it is desirable to do so.

In another aspect the invention includes a dispensing device (for example, a caulking gun) comprising:

a sealable tubular housing, extending along a first longitudinal axis, between a dispensing end and an opposing end, for receiving a coaxially aligned tubular container of dispensable viscous fluid;

a nozzle assembly adjacent the dispensing end, for viscous fluid communication with the tubular container, the nozzle assembly comprising a nozzle valve operating between an open position and a closed position;

a control for operating the nozzle valve between the open and closed positions;

a reservoir for storing compressed air;

a conduit for communication of the compressed air between the reservoir and the housing to express the viscous fluid from within the housing; and

a hand operated pump to supply the compressed air to the reservoir.

In another aspect, the dispensing device may be designed to couple with a detachable compressed air source, for example, a hand operated air pump. In that case, the reservoir will be used to store compressed air received from the detachable air source, (for example, a hand operated air pump).

In another aspect, the invention may be used with a nozzle assembly (or components of the nozzle assembly, such as the nozzle base) that will come fixed to the viscous fluid container. In other instances, durable, wear resistant components of the assembly may come fixed to the dispensing device, as part of an OEM dispensing device. Some or all of the components in the nozzle assembly may be replaceable.

The dispensing device of the present invention may provide one or more of the following advantages or other advantages which will become apparent upon a review of the present specification. By way of an example, one or more of the following advantages may be obtained:

- Various embodiments of the dispensing device will dispense viscous materials at a variable flow rate. The dispensing device may include compatible nozzle assemblies, or nozzle tips and replaceable components.
- Certain embodiments of the invention will be adaptable for use with rigid, tube type containers and with sausage type containers for dispensable fluids.

- In some instances, a compatible reusable, and reattachable nozzle assembly may be provided, to be fully interchangeable with other nozzle components, and capable of providing variations in flow volumes, patterns and extruded bead sizes.
- In some instances, the device may include a fully interchangeable, disposable nozzle assembly suitable for use with a plurality of interchangeable nozzle tips.
- The dispensing device may be compatible with a range of pressurized fluid sources. For example, some devices may be compatible for charging with pressurized air from stationary or movable compressors, portable gas sources such as large, pre-filled cylinders or vessels, hand operated air pumps, and other externally powered sources. In some instances, it may be desirable to provide a reservoir to receive a pressurized CO_2 cartridge, or other filled gas cylinder.
- A reservoir to store compressed gas may be provided with a compartment defined by the dispensing device. The reservoir may be replenished occasionally with compressed gas by connecting the reservoir to an external compressed gas source. The reservoir may also be a modular unit suitable for replacement with different reservoirs, or permitting addition of supplementary reservoirs to increase the storage capacity for compressed gas.
- One or more of these advantages, or other advantages, may be available to those who use embodiments of the present invention.

The foregoing are only some examples of certain embodiments of the invention. Many other embodiments, variations and derivations will become apparent from a review of the entire description, including the appended drawings.

IN THE DRAWINGS

Certain specific embodiments of the invention will be described with reference to the following drawings in which:

Figure 1A is a side view, in partial section, of a first embodiment of the invention in a first operating position.

Figure 1B is another side view, in partial section, of the first embodiment of the invention, shown in a second operating position.

Figure 2A is an enlarged side view of the first embodiment, in partial section, showing a portion of the dispensing end of the first embodiment, when in the first operating position.

Figure 2B is an enlarged side view of the first embodiment, in partial section, showing a portion of the dispensing end of the first embodiment, when in the second operating position.

Figure 3A is a partial sectional view of a closure cap at a loading end of the first embodiment of the invention, when the cap is in a closed position.

Figure 3B is a partial sectional view of the closure cap of **Fig. 3A**, when the cap is in a partially open position.

Figure 4 is a partial side view of a second embodiment of the present invention.

Figure 5 is an enlarged side view, in partial section, of a third embodiment.

Figure 6 is a partially exploded side view, in partial section, of the third embodiment shown in **Figur 5**.

Figur 7A is a partially exploded side view, in partial section, of certain components of the third embodiment shown in a first operating position.

Figur 7B is a partially exploded side view, in partial section, of certain components of the third embodiment shown in a second operating position.

Figure 7C is a top view of certain components of a fourth embodiment, shown in a first operating position.

Figure 7D is a top view of the components of the fourth embodiment shown in **Figure 7C**, in a second operating position.

Figure 7E is a side view (and a related top view, in partial section) of certain components of a fifth embodiment, shown in a first operating position.

Figure 7F is a side view (and a related top view, in partial section) of the components of the fifth embodiment, shown in a second operating position.

Figure 8 is an exploded view, in partial section, of certain components of the first embodiment of the present invention.

Figure 9 is an enlarged side view of a closure cap in a sixth embodiment of the present invention.

Figure 10 is a side view of the closure cap of **Figure 9**, shown in section, installed at the loading end of a dispensing device of the present invention.

Figure 11 is a right end view of the closure cap shown in **Figures 9** and **10**, installed in a dispensing device.

Figure 12A is a partial sectional view of the closure cap of **Figure 3A** shown in use in a trimming operation with a caulking cartridge, and a related exploded view, in partial section, of certain components of the illustrated closure cap.

Figur 12B is an enlarged partial side view of an embodiment of a pressure relief valve assembly shown in **Figure 12A**, seated in a fully closed position.

Figure 12C is an enlarged partial side view of the pressure relief valve assembly of **Figur 12B**, shown in an operator opened position.

Figur 12D is an enlarged partial side view of the pressure relief valve assembly of **Figure 12B**, shown in a pressure activated open position.

Figure 12E is an enlarged partial view, in perspective, of the closure cap of **Figure 3A**, showing an exterior portion of the pressure relief valve assembly of **Figure 12B**.

Figure 13 is a partial sectional view of the closure cap of **Figures 9 to 11** shown in use in a trimming operation with a caulking cartridge.

Figure 14 is an enlarged partial sectional view of the closure cap of **Figure 13** shown in use in a trimming operation with a caulking cartridge.

Figure 15 is a side view, in section, of a component for use with a dispensing device suitable for dispensing fluids from sausage type containers.

Figure 16 is a side view, in section, of a sausage type container.

Figure 17 is a side view, in section, of another component (namely, a plunger cap) for use with a dispensing device suitable for use with sausage type containers.

Figure 17A is a side view, in section, of another embodiment of a plunger cap for use with a dispensing device suitable for use with sausage type containers.

Figure 18 is a side view, in partial section, of a seventh embodiment of the invention.

Figure 18A is an enlarged side view, in partial section, of the dispensing end of the embodiment illustrated in **Figure 18**.

Figure 19A is a side view of another embodiment of the invention, coupled with a detachable hand operated air pump.

Figure **19B** is an end view of a detachable housing shown in isolation from the other components of the embodiment shown in **Figure 19A**.

Figure 20 is a side view of yet another embodiment of the invention, including an integral hand operated air pump.

Figure 21 is an enlarged side view, in partial section, of the hand operated air pump in position for use.

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS OF THE INVENTION

With reference to **Figures 1A, 1B, 2A** and **2B**, a dispensing device **1** is shown with an air tight housing **9**. The air tight housing **9** contains a tube **10** for storing a viscous, flowable material **F**, such as for example, caulking, sealant, mastic, or adhesive. The dispensing device **1** is provided with a handle grip **2** positioned below the housing, intermediate the dispensing end **6** and loading end **7**. A control trigger **3** (used to activate the dispensing nozzle assembly **20** and permit pressurized gas to act on the material **F**) is pivotally mounted on the handle **2**. Trigger **3** is operatively connected (by attachment at guide pin **30**) to a flexible, but non-compressible, guide strap **31**. The guide strap **31** is part of a guide **21** which operatively connects the movable trigger **3** to the rotatable spindle **25**, at the spindle driver **28**. Guide **21** is operatively connected to a rotatable guide mount **22** so that the guide mount **22** will rotate upon sliding movement of the guide **21**. Guide retainer **62** is positioned between the housing **9** and the guide mount **22** to hold guide mount **22** within its operating position in the frame **110** of the dispensing device. Guide **21** travels within a longitudinal channel **34** formed within the frame **110** of the dispensing device. The guide **21** is urged by spring **17** to return to a preferred position (illustrated in this case as being the closed position), so that the trigger **3** will return to its fully extended position, and shut off flow of fluid **F** through the nozzle assembly.

A pressurized gas (for example CO_2) is stored in a replaceable cylinder **4**. In alternative embodiments, the handle may define an air tight reservoir for storage of pressurized gas supplied from an exterior source, for example an air pump,

pressurized air hose or other gas supply. The pressurized gas within the cylinder **4** is in fluid communication with a pressure regulator **5**. The regulator **5** is provided to reduce the pressure of the gas flowing to the air tight housing **9** from an initial, relatively high storage pressure, to a lower operating pressure, typically in the range of about 20 to 90 psi. Of course, persons skilled in the art will understand that in some instances pressure regulators will not be required because of the range of pressures obtained in some designs, and in other instances, where regulators are used, the operating ranges of the regulators will vary. The regulator **5** is in fluid communication with the interior of air tight housing **9**. The regulator **5** is provided with an adjustable knob **51** to allow the operator to set or adjust the gas pressure supplied from the gas cylinder **4** to the interior of the housing **9**. It will be understood that some embodiments of the invention will not require a pressure regulator. In other embodiments, it may be desirable to use other types and designs of pressure regulators, including non-adjustable pressure regulators which are preset for operation within a range of acceptable operating pressures.

Gas cylinder **4** is securely nested within an air tight, pressurizable reservoir **46**. When a gas cylinder is spent, a similar loaded, replacement cylinder may be introduced into the reservoir by first removing threaded handle plug **48** from the handle grip **2**. After the operator has confirmed that all residual gas has been safely vented, the spent cylinder **4** is then withdrawn and the replacement cylinder is introduced into the reservoir **46**. The operator then engages the threaded coupling **49** by advancing threaded handle plug **48** into the handle grip **2**. As the replacement cylinder **4** is advanced into the reservoir **46**, a reinforced hollow needle **53** punctures the cap of cylinder **4** to create a pressurized gas inlet into a gas valve assembly including a valve ball **38** nested within valve inlet chamber **44**. Compressible seal **55** and O-ring seal **57** are positioned to inhibit leakage of gases from the cylinder **4** when it is positioned within the handle grip. Valve ball **38** is preferentially urged into

a closed valve position by valve spring **56** as illustrated in **Figure 2A** (corresponding also to the device as shown in the closed position in **Figure 1A**). Valve ball **38** is seated within its closed position when the trigger **3** is in its closed position shown in **Figure 1A**. Similarly, nozzle valve spindle **25** is in the fully closed position. However, when the trigger **3** is depressed by the operator, the trigger rotates about trigger mounting pin **33**, and integral elevated cam portion **35** advances to act upon plunger **36** which is seated within plunger seal **37**. As the plunger **36** advances by action of cam portion **35**, plunger **36** pushes valve ball **38** from the fully closed position, thereby allowing pressurized gas to flow from the cylinder **4**, through regulator inlet channel **39** and into regulator **5**. The regulator **5** acts to reduce the operating pressure of the gas from a relatively high pressure of the cylinder contents, to a lower operating pressure suitable for the operating conditions of the dispensing device **1**. The incoming gas, (now at a reduced pressure) travels from the pressure regulator **5**, through gas feed channel **45**, and into the interior of the air tight housing **9**. A gasket or seal **47** is provided adjacent the feed channel **45**, between the regulator **5** and the housing **9**, to inhibit leakage of gas from the dispensing device.

In this embodiment, the incoming pressurized gas is fed into a gap **8** between the side wall of the tube **10** and the inner surface of the housing **9**. Tube **10** is preferably slide-fit within the housing **9** so that a relatively small gap **8** is formed. Typically, the gap will be in the range of about 0.005 inches to about 0.010 inches, although the gap **8** may be larger or smaller in some instances. The gap **8** surrounds the outer periphery of the tube **10**, to allow the pressurized gas to surround and act upon the outer cylinder wall of the tube, and also to act upon the cartridge plunger **80** (shown in **Figure 5** and **Figure 10**). The pressurized gas (which fills a gap extending along the length of the tube **10**) within the air tight housing inhibits the outer cylinder wall of the tube from ballooning outwardly to fill the gap (as might otherwise occur if all pressurized gas is directed to a plunger cap at the loading end **7**). When the trigger

3 is depressed, the nozzle will be opened, the pressurized gas will be allowed to act on the plunger **80**, causing the plunger to advance, and thereby force viscous fluid **F** to flow through an opening in the nozzle tip and to apply a bead of material on the target surface.

In some embodiments, another form of operator activated control may be used, for example, a button, dial, slider, lever or other suitable element. In any case, the control element (for example, a trigger) may be provided with adjustable settings which allow the operator to identify and mark preferred control positions. For example, it may be desirable for the operator to preset one or more preferred positions corresponding to different fluid viscosities and types of viscous fluids to be dispensed. Detents may also be associated with one or more preferred positions within the range of operational movement of the control element. In some cases, the detents may be adjustable by the operator. In other instances, the detents may be predetermined.

In this embodiment, handle grip **48** is provided with an optional threaded air valve **50** seated within the base of the handle grip **48**. If an operator wishes to forego the use of a replaceable cylinder **4**, a conventional air pump (or other gas supply) may be coupled with the air valve **50** to pump air through air valve **50**, and through gas inlet **52**. The internal reservoir may be filled with pressurized air, and subsequently recharged, as needed, to operate the device.

In this instance, tube **10** is a conventional rigid container made from an extruded thermoplastic material, or spiral wound cardboard. Of course, alternate containers may be accommodated within other embodiments of the dispensing device **1**. The tube **10** is loaded into the device **1** through a loading port at loading end **7**, illustrated as being sealed by chamber cap **600**. Cap **600** is locked in position, to form an effective seal to inhibit escape of pressurized gases from the interior of the housing **9** while the device **1** is in operation. Preferably, the device **1** is provided with safety

features to seal the air tight chamber for operation within a predetermined range of operating pressures. In the illustrated embodiment, chamber cap **600** is provided with a pressure relief valve **54** which is preset to release excess gas in the event that the gases within the air tight chamber reach a pressure in excess of a preset limit. In the event of over pressurization, excess gas is vented through the pressure relief valve. The pressure relief valve may also be designed to allow an operator to selectively vent the gases from the interior of the housing **9**, if desired. A second pressure relief safety valve **58** is closed when the chamber cap **600** is in the fully closed position. However, as the operator twists the chamber cap **600** toward an opening direction, safety valve **58** will vent pressurized gas from within the air tight chamber **9**, before the chamber cap **600** is fully disengaged from lock pin **605** and before the cap is fully released from the housing **9**.

Tube **10** comprises an outwardly projecting shoulder **11** which forms a rim about front wall **15** of tube **10**. A stem **12** projects outwardly from front wall **15**. The stem **12** terminates at end **13**, and defines an outlet bore **14** defining a fluid communication path with fluid contents **F** in tube **10.** Nozzle assembly **20** is configured to securely receive stem **12** and define an enclosed fluid path from the interior of the tube **10** to the interior of the nozzle assembly **20**. The base of the nozzle assembly **20** includes mounting flange **32** which projects radially, outwardly from the longitudinal axis of the nozzle assembly **20**. The base of the nozzle assembly **20** is sealed against O-ring **43** and the front **41** of the housing **9**. When the nozzle assembly **20** is securely positioned relative to stem **12** of tube **10**, stem end **13** will abut against nozzle seal **42** positioned within the nozzle base. Similarly, it is preferred that the mounting flange **32** abut against front wall **15** to further re-enforce front wall **15** against excessive deflection or movement when the fluid contents **F** are pressurized. The base of nozzle assembly **20** defines a spindle housing **27**. Spindle **25** is retained with spindle housing **27** and is permitted to rotate so that the through bore, which

defines spindle channel **26,** may be moved between open and closed positions. In the closed position, spindle channel **26** is oriented transversely to the internal, tapered cavity **24** extending along the longitudinal axis of the nozzle assembly **20.** In the closed position, spindle **25** prevents fluid communication between tapered cavity **24** and bore **14** of tube **10**. Entrance cavity **29** defines a closable opening to a fluid flow path along the longitudinal axis of the nozzle assembly **20**. Rotatable spindle **25** is moved between open and closed positions via spindle driver **28**. Spindle driver **28** may be connected to an actuator assembly in a caulking gun or other suitable dispensing device. Upon rotation of spindle **25** about its rotational axis, spindle channel **26** may be oriented in a plurality of partially, offset positions to impart variable flow rates of fluid **F** travelling between the interior chamber of tube **10** and nozzle tip **23** of nozzle assembly **20.** In a preferred embodiment, the tapered nozzle assembly **20** is provided to the user with a closed end including a removable reclosure cap **305** at the dispensing end **6** of dispensing device, shown positioned over nozzle tip **23** in **Figure 1A**. In many instances, the nozzle assembly, and in particular the nozzle tip **23** may be made of molded thermoplastic material. Pre-marked cut lines (not shown) may be provided to suggest appropriate points at which the closed end may be cut away from nozzle assembly **20,** to form a dispensing outlet on nozzle tip **23**. As more of the closed end is cut away from the tapered nozzle tip **23,** a larger dispensing outlet is formed, to permit a wider bead of dispensed material to flow through tapered cavity **24.**

With reference to **Figures 3A, 3B**, and **4**, two alternative chamber caps **600** and **600'** are illustrated. A chamber cap **600** is provided to secure a standard sized tube or cartridge (for example, a caulking cartridge) within the housing **9**. In **Figure 3A**, the chamber cap **600** is shown in the fully sealed position, so that lock pin **605** is fully engaged within channel **601** defined between retainer arm **606** and the main body of cap **600**. Safety valve **58** is aligned to seal chamber opening **607,** shown in **Figur**

3B. An O-ring **614** fitted within rim **611** provides a gas tight seal between the cap **600** and the housing **9**, to inhibit leakage of pressurized gas from the device **1**. As the chamber cap **600** is displaced away from channel end **603** to a partially opened position, and safety valve **58** is displaced from opening **607**, to allow any pressurized gas to vent to atmosphere, before the cap **600** is fully disengaged from the housing. A detent **604** is provided adjacent the end of arm **606**, to encourage the operator to pause while opening the chamber cap **600**, so that the pressurized gas is completely exhausted before the cap is fully disengaged. **Figure 4** illustrates an extended mounting cap **600'** provided to enclose a cartridge, tube or other container of greater length. For example, some sealants, and other viscous materials are packaged in substantially elongated tubes and containers that will not fit within standard housings. An elongated chamber cap **600'** may be provided to extend the effective length (and interior volume) of the air tight housing **9**. The cap **600'** is secured to housing **9** by engaging lock pin **605'** in channel **601'**, defined between retainer arm **606'** and the main body of the cap **600'**. When the cap is fully engaged with the housing **9**, the lock pin **605** abuts against channel end **603'**. A detent **604** is also provided on retainer arm **606'** to encourage the operator to pause before fully disengaging the cap from the housing. Although a safety valve is not shown in **Figure 4**, a safety valve or other venting arrangement is preferred to ensure that any remaining gases are fully exhausted before the cap is fully disengaged.

With reference to **Figure 5**, **Figure 6**, and **Figures 7A** to **7F**, a dispensing device is illustrated with an alternative flexible guide strap assembly **61**. One flexible end portion of strap assembly **61** is secured at guide pin **30'** to trigger spool **93**. Trigger lock **16** is used to selectively lock the trigger **3** to prevent accidental operation of the device. When the trigger is unlocked, and depressed by the operator, the elevated cam portion **35'** presses against plunger **36** to activate the ball valve assembly. Pressurized gas is allowed to travel through the pressure regulator, reducing the

pressure of the gas traveling through gas feed channel **45**, and into chamber space **81**, to act on the outer surface of the cartridge plunger **80**. The loading end **7** of the dispensing device is sealed by chamber cap **600**. Chamber cap **600** is defined in part by an internal wall **610**. Compressible rubber springs **613** are placed within an inner channel, along an inner wall of the chamber cap **600'**. When the chamber cap **600'** is fully engaged with the housing **9**, the compressible rubber springs **613** abut against the adjacent end of the tube **10**, to urge the tube **10** toward the dispensing end **6**, thereby forming a tight seal between stem **12** (on tube **10**) and O-ring **42**. Seal **614** provides a gas tight barrier against leakage of gas from the interior of the device. At the dispensing end **6** of the device, guide assembly **61**, and consequently interconnected nozzle spindle **25** and the ball valve assembly, are urged by spring **60** to return to a preferred position, which in this instance is the closed position. In the preferred embodiment, the flexible end portion **61'** of the guide strap assembly is wound about circular spool **90** provided on the guide mount **22** when the trigger is released, and the nozzle is closed as shown in **Figure 7A**. However, as shown in **Figure 7B**, when the trigger is depressed and the nozzle is opened, the opposite end of the guide strap assembly **61** is wound about circular trigger spool **93**.

Persons skilled in the art will appreciate that there may be instances in which it is desirable for operators to have a greater degree of control available for operation of the nozzle. Cams of various relative shapes and sizes may be provided to impart different operating characteristics. For example, it may be desirable to provide a greater degree of control or sensitivity as the nozzle approaches a fully opened position as the spindle channel **26** approaches alignment with tapered cavity **24**. In other instances, it may be desirable to impart different operating characteristics at other operating positions. By way of example, **Figures 7C** and **7D** illustrate an alternative embodiment of the guide strap assembly in which the guide mount **22'** is fitted with cam **92** to impart a nonlinear opening movement for the nozzle valve

relative to the movement of the trigger **3**. In this embodiment, the opposite end of the guide strap **61** is attached to a circular trigger spool (not shown). In **Figur s 7E** and **7F**, yet another guide strap assembly is illustrated in which the opposite end of the guide strap **61** is connected at guide pin **30'** to a cammed spool portion **94** provided on the trigger **3** whereas strap portion **61'** is secured to a circular spool **90**. Of course, other features may be used to vary the rate of opening the nozzle valve, or if desired, to vary the operating gas pressure used to urge the cartridge plunger **80** against fluid **F**.

Figure 8 is an exploded view of the main components of the ball valve assembly in the preferred embodiment, shown apart from the gas cylinder **4** and handle plug **48**. When installed, air valve **50** is seated within valve seat **59**. Threaded portion **48'** of the handle plug is used to secure the plug **48** to the main portion of the handle **2**.

Figures 10 and **11** illustrate enlarged views of the preferred chamber cap **600**. Internal pressure indicator **641** displays the pressure readings via an indicator needle **640** visible to the operator. The pressure indicator may be calibrated so that the needle may be used to display readings along a graduated scale clearly marked for viewing by the operator. The exterior of the chamber cap **600** is provided with knife **630** secured by mounting screw **620** to knife base **625**.

Figure 9 illustrates a modified chamber cap **660** with a ramped closure portion **662** on retainer arm **661**. The chamber cap **660** is shown in the fully sealed position, in which the lock pin **605** is fully seated within recess **666**, corresponding to a detent. It will be understood that the rubber springs **613** are compressible, and that the operator will be able to engage the lock pin **605** with the end of the retainer arm **661** using a moderate force. However, the operator will face added resistance as the operator must further compress the rubber springs **613**, thereby improving the quality of the seal at the front end of the tube, as the pin is advanced along ramped portion **662** toward the fully sealed position at detent **666**.

In some instances, a caulking tube **10** or other container may come with a pre-attached, elongated nozzle made of a thermoplastic material or other material which may be cut and trimmed. For example, many cartridges used for sealants, including, caulking, adhesives, and other dispensable, viscous materials are provided with such pre-attached, hollow nozzles. In **Figure 12A** and **13**, such a cartridge, for example, tube **10** is originally provided with an elongated nozzle piece **115**. The nozzle **115** may be cut by the user to an intermediate length represented by pre-cut end **113**. The remaining, hollow stem portion **112** may be trimmed to a pre-selected, desired length by rotational engagement with a knife **630** securely mounted within a modified chamber cap **600'** or **660**. In the illustrated embodiments, chamber caps **600', 660** include a knife **630** secured with a mounting screw **620**, to a knife base **625**. In some embodiments, it will be particularly important to ensure that the stem on the tube is cut to a required length, to ensure a suitable and secure fluid connection with the nozzle assembly. Although the foregoing examples describe a knife mounted within a chamber cap, similar pre-set cutting and trimming features may be included within another component of the dispensing device (not shown) or as a separate tool (not shown) which may be included in a nozzle assembly installation kit.

Figures 12A, **13** and **14** illustrate a trimming step involving the use of the knife **630** to trim away excess material from a remaining stem on the tube **10**. A cut away portion **115** of the preattached thermoplastic nozzle is discarded. In the chamber cap **660** illustrated in **Figures 13** and **14**, inwardly projecting rimmed ledge **669** is provided on the exterior wall of the chamber cap **660** so that, when the rimmed ledge **669** is engaged with the shoulder **11** of the tube **10**, the precut stem is properly positioned and centered relative to the knife **630**. Precut stem end **113** is positioned in contact with the edge of knife **630** so that the stem end **113** will be trimmed as the tube **10** is pressed against, and rotated relative to, the knife **630**. The trimming step is completed leaving a finished stem **112** of a predetermined length so that the

overall cartridge dimensions are suitable for loading within the housing **9** of the dispensing device. On the other hand, the chamber cap **600'** illustrated in **Figur 12A** lacks an inwardly projecting ledge **669** and the knife is hidden within the interior of the housing when the cap is in place to seal the housing. For example, it may be desirable to hide the knife and its cutting edge to avoid accidental injuries or damage to the knife blade. In this embodiment, chamber cap **600'** has a knife **630** fixed on the interior of the end wall so that the shoulder **11** of the tube **10** abuts against rubber springs **613** when the tube is rotated to trim away excess material from the stem **112**.

Figure 12A also shows an example of a dual-function pressure relief valve assembly **54**. The pressure relief valve assembly **54** is also shown in **Figures 12B**, **12C**, **12D**, and **12E**. The pressure relief valve assembly includes a relief valve defining an elongated body with inner flange **153** and opposing outer flange **154**. Relief valve **54** is slidefit within a multi-channeled port defined within the end wall **699** of the cap **600'**. A partially compressed spring **150** is snugly fit within a first space defined between the outer surface of the end wall **699** and outer flange **154**. The spring **150** urges the relief valve to stay within the fully closed position (also shown in **Figure 12C**). Valve seal **152** is seated within a recess **151** defined by raised collar **155**. When the relief valve is in the fully closed position, the inner flange **153** rests tightly against valve seal **152** so that, when the dispensing device is in normal operation, within acceptable pressure limits, the relief valve **54** is seated in a fully closed, and sealed position. However, as shown in **Figure 12E**, if the internal gas pressure in the housing exceeds a preset limit, the relief valve **54** is displaced outwardly. This outward displacement of relief valve **54** creates a vented opening (between seal **152** and flange **153**, around flange lip **153'**, through basin **156**, and out through a plurality of channels **157** defined between opposing radially projecting retaining fingers **158**) to allow excess gas to escape, thereby reducing the internal gas pressure. Valve seal **152** may be constructed of suitable material to be deformable, with a memory,

so that the valve seal may be reused and the inner flange **153** may be reseated against the valve seal **152** in the fully closed, and sealed position, after the over pressurization has been corrected. The relief valve **54** is also configured to allow the operator to press outer flange **154** inwardly (as shown in **Figure 12D**) to compress spring **150**, and in turn unseat inner flange **153** from the inner valve seal **152**, to exhaust pressurized gas from the interior of the housing. The operator may use relief valve **54** to completely exhaust the pressurized gas from the chamber before removing the chamber cap **600'** from the housing.

The dispensing device of the invention is also useful for dispensing viscous fluids from prepackaged sausage type containers. **Figures 15, 16, 17, 17A, 18**, and **18A** illustrate embodiments of the invention adapted to dispense fluid from sausage type containers **510**. **Figures 18** and **18A** show a modified housing **9'** locked into a sealed, air tight position, in alignment with the nozzle assembly and with the gas supply from the pressure regulator **5**. Unlike the embodiments of the housing **9** shown in **Figures 1A, 1B, 2A**, and **2B** which provided an equalized pressure surrounding the side walls of the tube **10** and slidable plunger within the tube **10**, the housing **9'** is modified to direct the operative pressurized gas stream toward the loading end of the device, into the gas chamber **553**, to act against plunger cap **680**. As shown in this example, pressure reduced gas exits regulator valve **551**, into gas supply line **552** which is directed toward the chamber **553** formed between the plunger cap **680** and chamber cap **670**. Sealed, crimped end **518** of sausage type container **510** is positioned against concave end wall **682** of plunger cap **680**. The crimped seal at end **518** nests within recess **685** within the plunger cap **680**. Side wall **681** of the plunger cap **680** fits snugly within the housing **9'** to form a gas tight seal while allowing the plunger cap to slide within the housing toward dispensing end **6** during operation. As the dispensing device is operated and the plunger **680** advances along the longitudinal axis of the housing toward the dispensing end **6**, and

more fluid is expelled from container **510**, the emptied portion of the sausage liner tends to fold and gather inwardly, toward the center of the concave end wall **685**. An alternative embodiment of the plunger cap **690** is shown (in **Figur 17A**) having side wall **691** forming annular pocket **692** to receive the empty, folded liner **531** of the sausage type container **510**. Crimped end **518** of the sausage type container nests within a recess **695**.

With referenced to the exploded views of **Figures 15**, **16** and **17** and the assembled view of **Figure 18**, the opened end **513** of the sausage type container **510** is loaded to snugly fit within a front cap **516**, positioned at the dispensing end **6**, adjacent the nozzle assembly **20'**. Front cap **516** is one example of a funnel which may be used to channel viscous fluid **F** from the open end **513** of the sausage type container **510** toward the nozzle. Open end **513** fits within bore **514** of the front cap **516**, with shoulder portions **519** of the sausage type container abutting against front wall **515** of front cap **516**. The front cap **516** is formed with a stem **512** and shoulder **511** of predetermined, suitable lengths to properly fit within the housing, in sealed engagement, when the sausage type container is loaded and sealed into the housing **9'** for operation. O-ring **43** and nozzle seal **42** are fitted against the base of the nozzle assembly **20'** to inhibit escape of gas and viscous material from the interior of the housing **9'**. Outer wall **517** of front cap **516** tightly fits against the interior surface of the housing **9'**. A gas tight plug **580** is shown blocking a longitudinal bore extending along the length of an extruded embodiment of the housing **9**. The plug **580** defines a terminal end to gas supply line **552**, so that pressurized gas is channeled to the interior of the housing, via a co-aligned segment of the gas supply line extending within chamber cap **670**, to exert pressure against the plunger **680**.

The invention also includes a kit for adapting sausage type containers for use in gas operated dispensing devices. By way of example, one embodiment of the kit comprises the front cap **516**, the sausage type container **510**, and the plunger **680**

shown in **Figures 15**, **16** and **17**. In another embodiment, the kit comprises the front cap **516**, the sausage type container **510** and the plunger **690** shown in **Figures 15**, **16** and **17A**. In one aspect, the kit is intended for use with a gas powered dispensing device (which, by way of example, may be a caulking gun). Typically, the dispensing device will have a sealable tubular housing that will be in fluid communication with a source of pressurized gas. The dispensing device will also have a nozzle assembly for dispensing a viscous fluid from within the tubular housing. The kit will include a collapsible tubular container, for example, a sausage type container having flexible outer walls, filled with a viscous fluid. The collapsible tubular container defines a first end with a sealed opening and a closed end opposite the first end. A funnel is first inserted into the tubular housing. When the first end is opened and the collapsible tubular container is inserted into the tubular housing, the funnel is positioned intermediate the nozzle assembly and the opened, first end of the sausage type container. When inserted, the funnel provides a sealable communication path between the first end and the nozzle assembly. The kit also includes a plunger that is inserted into the housing, adjacent the closed end of the sausage, so that plunger slides within the tubular housing. When inserted, the plunger forms a movable seal between the source of pressurized gas and the collapsible tubular container. In other embodiments, the plunger defines a cap with a recess. The recess is configured to receive a crimped seal at the closed end of the sausage type container. This recess may also receive a folded portion of the outer wall of the sausage type container when some of the viscous fluid is expressed from within the sausage type container. In another embodiment, the cap may have a first recess to receive the crimped seal and a second recess to receive the folded portion of the outer wall of the sausage type container. Other embodiments are also possible.

With reference to **Figure 18A**, an alternative nozzle assembly **20"** is shown having an integral front cap portion defined by a shoulder **571** extending to side wall **572**. In

this embodiment, the nozzle assembly and front cap are formed as one unitary work piece. A modified guide retainer **562** secures guide mount **22** and a portion of the guide strap assembly within the frame of the dispensing device. O-ring **573** forms a gas tight seal to prevent escape of gas in the space between the front end wall of the housing and shoulder **571**. Sausage type container **510** is loaded within housing **9'**, with open end **513** adjacent entrance cavity **29** of the nozzle assembly **20"**. When the trigger of the dispensing device is depressed (with the end cap **305** removed), the spindle **25** is rotated within spindle housing **27**, as the strap **61** is moved by the trigger action. As the strap **61** is pulled, the spindle opening **26** is aligned with the tapered channel **24**, and the plunger cap is urged toward the dispensing end **6** to expel fluid **F** from the sausage container **510**.

Figure 19A shows an alternative arrangement for storing pressurized gas within the storage reservoir in the handle grip **2** of the dispensing device. CO_2 cylinder **4** is removed from the internal reservoir. A hand operated air pump **P** is coupled with air valve **50** so that pumping action of the pump handle (indicated by arrows **A**, **B**) will charge the reservoir with air. The pump may be used to recharge the reservoir with pressurized air as needed to dispense fluids from the device. **Figure 19B** shows an end view of a removable housing **9'** which includes an additional storage compartment **98** for storage of compressed air received from the hand operated pump **P**. In this embodiment, the removable housing **9'** is secured to the base of dispensing device **1** along tracks **99** which engage with corresponding recesses defined within the base (not shown). Of course, other features may be used to removably secure the housing to the base of the dispensing device **1**. It will also be appreciated that the reservoir may have multiple compartments for storage of pressurized gas. One of the storage compartments may be located within the handle grip. Each storage compartment may be provided with separate valves to selectively control flow of pressurized gas into and out of the storage compartments. In some

embodiments, it may be desirable to have a reservoir for compressed air within the housing and a separate reservoir for receiving a CO_2 cylinder within the handle grip. Other configurations and variations are also possible.

Figure 20 and **Figure 21** show an alternative hand operated air pump arrangement in which a foldable pump lever **200** engages back wall **220** of handle grip **2'**. A portion of back wall **220** fits within a receiving channel **205** of corresponding dimensions. Pump handle **201** spins freely relative to pump lever **200**, for added comfort when the operator turns the lever **200**. Pump lever **200** pivots relative to hub **202** about pivot pins **203**. Hub **202** is coupled to rotatable pump stem **207** fitted with offset coupling pin **210**. Coupling pin **210** is rotatably connected to pump piston **209** which travels along a defined stroke path within cylindrical bore **250**. As air is compressed by upward movement of the piston **209** within bore **250**, one way valve **211** is urged open and additional air is introduced into internal air reservoir **215**.

In one aspect, the nozzle assembly is preferably made of a rigid, inexpensive material such as thermoplastic. In other instances, it may be desirable to include components made from different materials. By way of example, in certain instances, it may be desirable to inhibit sticking or seizure of the valve spindle within the spindle housing. As an example, the valve spindle may be made of Teflon™ or other material selected to allow free rotational movement of the spindle within the spindle housing. By way of example, Teflon™ or other materials may be selected for their compatibility with other materials of construction and dispensable fluids. For example, certain thermoplastics are less prone to sticking or seizure when used in connection with certain types of dispensable fluids such as adhesives. In other instances, one or more components may be made from metal, alloys, or other resilient, corrosion-resistant, rigid materials. In many instances, certain embodiments of the nozzle assembly will be made from inexpensive, thermoplastic materials having suitable performance characteristics to satisfy the needs of the particular

applications in which they will be used. Often, other nozzle assemblies made of inexpensive thermoplastic materials will be sufficiently inexpensive permitting users to throw away the nozzle assemblies after a single use, or if an assembly is damaged or rendered unusable due to clogging or other obstructions.

In other embodiments, the nozzle assembly may be designed for removable engagement with one or more caulking tubes or other containers for flowable, viscous materials. That is, certain embodiments of the nozzle assembly may be designed for reuse for extended periods of time, and with different types of dispensing containers.

In certain embodiments, the nozzle assembly will comprise a unitary body cast, molded or otherwise formed from a single work piece. The nozzle body may include a nozzle tip, a housing for a movable valve component such as a spindle or other gate and a mounting base. In other embodiments, the nozzle assembly may have a nozzle body made up of two or more interconnecting parts or components. For example, a modified nozzle body may have a mounting base designed to secure the base to a mounting stem on a caulking tube or other container. The mounting base will define a mounting end with which it will be secured to the mounting stem of the caulking tube. At the opposite end of the mounting base, an interchangeable nozzle tip may be secured. The interchangeable nozzle tip may also be provided with a corresponding cap to reclose the opening at the dispensing end of the nozzle tip. Of course, other multiple component variations of the nozzle assembly will also be possible. For example, the interchangeable nozzle tip component may be removable so that an alternative nozzle tip may be replaced for use within the nozzle assembly. Interchangeable nozzle tips may be provided with different, dispensing openings capable of extruding beads of different shapes and sizes. For example, the nozzle tip openings may come in a range of opening sizes capable of dispensing beads of different diameters and shapes. By providing interchangeable tips, an

operator will not be required to cut or shape the nozzle tip to obtain a particular nozzle opening size.

In some embodiments, it may be preferable to slide-fit the nozzle base within the housing. A retainer will be provided to prevent the nozzle assembly from dis-engaging from the housing when the interior of the housing is pressurized. After the contents are depressurized, and it is desired to remove the spent sausage, and the cap and nozzle assembly from the interior of cylinder housing, the nozzle assembly may be pushed inwardly into the interior of the cylinder housing along with the cap and spent sausage, for ultimate removal at the opposite end of the cylinder housing. For example, the spent sausage and nozzle assembly may be removed at the loading end of the dispensing device. In other embodiments, it will be possible to configure the housing and related coupling features so that the housing may be disengaged from the frame of the dispensing device, either for replacement with an alternative housing, for removal of a spent sausage type container, or for cleaning of the components of the device.

The foregoing are examples of certain aspects of the present invention. Many other embodiments, including modifications and variations thereof, are also possible and will become apparent to those skilled in the art upon a review of the invention as described herein. Accordingly, all suitable modifications, variations and equivalents may be resorted to, and such modifications, variations and equivalents are intended to fall within the scope of the invention as described herein and within the scope of any issued patent claims.